Teacher Perception of the Role and Impact of Mathematics Instructional Coaches in Their Classrooms

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Abstract

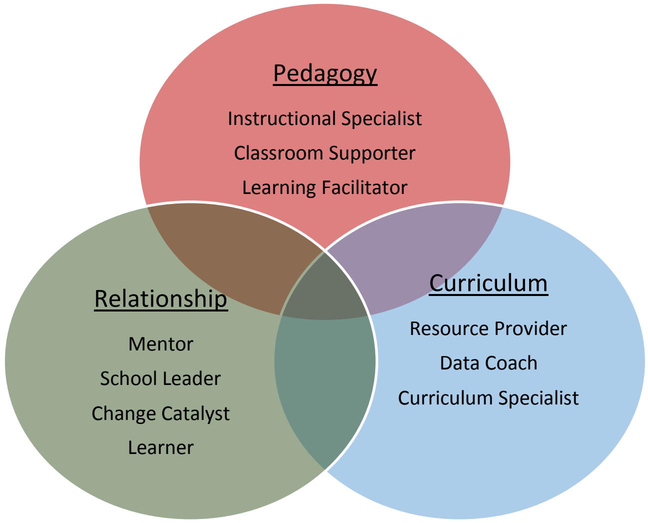
For more than 80 years, mathematics education has experienced numerous reforms ultimately resulting in the Commonwealth of Virginia's implementation of Standards of Learning (SOL) assessments at all grade levels. One county's response to this high-stakes testing was the addition of Mathematics Instructional Coaches (MICs). Surveying 200 K-12 teachers to determine which MIC category of roles they perceived had the most impact in their classrooms--relationship, curriculum, or pedagogy--a standard multiple regression revealed statistical significance(3,27) = 18.64, $p < .01$ in two of the three roles. The MIC categories of curriculum ($B = .49$, $p < .01$) and pedagogy ($B = .35$, $p = .04$) were found to significantly impact teacher perception, and while literature espoused interpersonal relationship higher in importance, this study found it not statistically significant ($B = .09$, $p = .52$). Acknowledging limited generalizability, several implications for administrators, MICs, and classroom teachers emerged.

Keywords: Mathematics Instructional Coach (MIC), curriculum, pedagogy, relationship, instructional coach (IC), COVID-19

1. Introduction

Despite numerous reform movements that date back more than three quarters of a century, students have struggled with mathematics skills, most recently making it a field ripe for instructional coaching (Will, 2020). To address this need, the Commonwealth of Virginia determined that employing Mathematics Instructional Coaches (MICs) was not only a way to support classroom teachers, but also to improve student performance. These MICs quickly began assuming a variety of roles, including those of resource provider, data coach, instructional specialist, curriculum specialist, classroom supporter, learning facilitator, mentor, school leader, change catalyst, and learner (Killion & Harrison, 2006, 2013). Grouped into three overarching categories--relationship (i.e., mentor, school leaders, change catalysts, and learners), content expertise (i.e., resource providers, data coaches, and curriculum specialists), and pedagogical knowledge (i.e., instructional specialists, classroom supporters, and learning facilitators; see Figure 1)--this study analyzed both classroom teacher perceptions of these MIC roles and the perceived impact of MICs in their classrooms.

Figure 1 *The Overarching Categories of Coaching Roles*



Note. This model illustrates Killion and Harrison's (2006, 2013) instructional roles for ICs, and while each appears in its own circle, the diagram shows they often overlap depending on how the roles are performed. Visual depiction is from *Teacher Perception of the Impact of Mathematics Instructional Coaching* by Reece, K. L. Copyright 2021.

2. Background/Literature Review

Herrera and Owens (2001) heralded that mathematics education has been of national concern since the early 1940s when "both educators and the public recognized that more technical and mathematical skills were needed to push forward the developing technological age" (p. 84). This push encouraged leaders of the 1950s to begin analyzing the mathematics curriculum and its preparation of high school students for further education. Reforms began in the 1960s with New Math emphasizing "deductive reasoning, set theory, rigorous proof, and abstraction" through Socratic dialogue and pedagogically appropriate discovery (Herrera & Owens, 2001, p. 91). This restructuring was widely supported until student performance made an alarming 10-year decline on the national Scholastic Aptitude Test, which prompted the 1970s Back-to-Basics reform focusing on computations and algebraic manipulation based on principles of behavioral psychology. This "prescriptive hierarchical curriculum" (Conference Board of the Mathematical Sciences, 1975, p. 12) failed "to meet the needs for basic mathematical literacy of average and low ability [K-12] students" (p. 11), which triggered the 1980s National Council of Teachers of Mathematics (NCTM) publication *Curriculum and Evaluation Standards for School Mathematics* (1989) launching Standards-Based reform.

With its emphasis on teaching *all* students, not just those who were college-bound, the Standards-Based movement advocated for changes in both content and pedagogy. Continuing to be inspired by this movement, the NCTM Commission on Standards for School Mathematics produced the *Professional Standards for Teaching Mathematics* in 1991 followed by the *Assessment Standards for Teaching Mathematics* in 1995, both of which explicitly described the instructional changes necessary to meet the new educational standards. This reform required teachers to alter their role from transmitters of knowledge to facilitators who guided the class in mathematical discovery, while mediating classroom discourse and creating a learning environment that was applicable to real-world situations. Herrera and Owens (2001) described these content changes as having a "central focus on the conceptual versus the merely procedural" (p. 89) and the pedagogical changes as dynamic, meaning students began to actively participate in the construction of knowledge.

As a means to support the impending change in teachers' roles, in 1999 the Kansas University Center for Research on Learning (KUCRL) partnered with the Topeka Kansas School District (TKSD) in the Pathways to Success Project (PTSP). Through this collaborative effort, they placed full-time instructional coaches (ICs) in six middle schools to "improve student achievement by enabling . . . teaching that demonstrate[d] fidelity to the scientifically proven critical teaching behaviors of the various interventions" (Knight, 2007, p. 13). At that time, a good IC was described as "an excellent teacher [who] is kind-hearted, respectful, patient, compassionate, and honest [with] high expectations and . . . affirmative and honest feedback that helps people to realize those expectations . . . [one who] can see something special in you that you didn't know was there and help you to make the something special become a living part of you" (pp. 15-16). Three years after ICs were placed in all TKSD middle schools, they were added to the three high schools.

Higher levels of success were achieved each year of the project and by 2004, the term *instructional coach* had been coined (Knight, 2017, p. 1). Over the subsequent years, Knight and the KUCRL continued implementing, refining, and evaluating IC programs to create effective coaching programs that positively impacted schools and student academic success (Knight, 2021).

Simultaneously, the Commonwealth of Virginia implemented the Standards of Learning (SOLs) providing a foundation for increased student achievement in all subjects including mathematics. In 2009, these SOL assessments were designed to have students college and career ready by utilizing "innovative technology-enhanced items (TEI) that required students to apply their content knowledge and employ problem-solving and critical-thinking skills . . . [all] widely praised by mathematics teachers and division-level instructional leaders" (VDOE, 2013, p. 40). However, after the alarming results of student pass rates decreasing from 85% to 68% (VDOE, 2019), division superintendents quickly responded by investigating both new instructional methods and professional development (PD) opportunities to assist teachers in most effectively implementing these revised standards. To address this need and the goals of the SOL tests, several counties began employing MICs with the understanding that to achieve student success, superintendent and administrative expectations had to be merged with teacher perceptions of these coaches and their roles in the classroom (DeWitt, 2015).

2.1 Teacher Perception of MICs' Professional Relationships with Teachers

It has been repeatedly documented that the foundation of all positive IC-teacher interactions is a trusting relationship (Hanover Research Report, 2014; Hull et al., 2009; Knight, 2009; Steiner & Kowal, 2007). As a catalyst for this relationship, successful MICs employ receptive body language, physical presence, both the ability and willingness to listen, accessibility and openness, encouraging words, and positive behavior (Kaiser et al., 2002). Knight (2004b) and the researchers at KUCRL further found that successful MICs also possess an infectious personality that helps them encourage and inspire teachers. In their study of MICs and how they might improve student performance, Hull et al. (2009) described these infectious personality traits as those cultivating a partnership that encourages respectful and supportive interchanges.

The Annenberg Institute for School Reform (AISR; 2004) reported the first step to establishing a partnership is to encourage"collaborative and reflective practices" (p. 2). When this is accomplished, teachers who work with MICs "apply their learning more deeply, frequently, and consistently" (p. 2). One example of this type of partnership is for the MIC to work in the teacher's classroom modeling new methods and strategies that encourage teachers to relate more openly and disclose their classroom challenges. This type of relationship can have a significant impact on the instruction transpiring in the classroom (AISR, 2004; Wolpert-Gawron, 2016); so, to establish and cultivate this partnership, MICs often serve as both mentor and fellow learner (Knight, 2007), while actively dispelling the misconception that they are supervisors or evaluators (Killion et al., 2012; Knight, 2011; Mason, 2007),

2.2 Teacher Perception of MICs' Knowledge of Curriculum Resources

To assist teachers with content questions, MICs must have a working knowledge of the state and national standards, district curriculum, pacing guides, scope and sequence, and specific content topics including "the developmental nature of mathematics and the interconnections among [its] concepts" (Hull et al., 2009, p. 6). Even with this expertise, studies (Horne, 2012; Preciado, 2015; Wolpert-Gawron, 2016) have shown inconsistent results of teachers' perceptions of MIC impact on the curriculum.

In a study of 536 K-12 teachers in three northeast Tennessee school systems, Horne (2012) reported no statistically significant support for the use of MICs with elementary teachers, $t(270) = .284$, $p = .777$; middle school teachers, $t(109) = .613$, $p = .541$; or high school teachers, $t(151) = 3.70$, $p<.001$. He stated that the differences in perception correlated with the grade level taught and the teacher's years of experience. In fact, Horne specified that teachers with 1 to 5 years of experience had negative perceptions of ICs, $t(126) = 2.95$, $p = .004$.

In contrast, in a mixed-methods study of 114 K-8 teachers in one California school district, Preciado (2015) found that teachers were generally in support of working with MICs. She noted that teachers with 16 to 25 years of experience were *more* receptive to MIC support with curriculum and instructional feedback than other groups. Similarly, Wolpert-Gawron (2016) later supported a positive teacher perception where the curriculum specialist role of MICs proved beneficial, especially with customizing curricula, creating pacing guides, and mapping ever-changing standards. She further asserted, "Teachers generally ask me to model a lesson using new educational technology techniques" (p. 57), while additionally requesting assistance researching or developing project-based learning units to encourage students with applied learning. MICs often assist teachers in areas they do not have as much time to investigate and develop.

2.3 Teacher Perception of MICs' Facilitation of Pedagogy

Bruce and Ross (2008) examined the effects of appropriate pedagogical practices and peer coaching on mathematics teaching practices and teacher beliefs of impact on student learning. In their qualitative study of 12 teachers--eight in Grade 3 and four in Grade 6--who participated in four training sessions on appropriate pedagogical practices and peer coaching, they reported a "positive impact on teacher efficacy and on teacher implementation of standards-based teaching" and summarized, "the combination of content-specific pedagogical training and peer coaching proved to be effective in supporting teachers in their implementation of innovative strategies" (p. 363). Three years later, Teemant et al. (2011) evaluated performance-based instructional coaching intended to improve teacher pedagogy and classroom models for educating diverse student populations. Assessing 21 elementary teachers, they reported that teacher use of a Standards for Effective Pedagogy rubric increased after each coaching cycle. Additionally, Teemant et al. found that "instructional coaching led to [a] significant transfer of new teaching skills from a workshop to the classroom" (p. 690). Similarly, Westmoreland (2015), Jasso (2018), and Polnitz (2020) agreed, teachers' perceptions of positive MIC impact happen through the role of classroom supporter and the use of pedagogically appropriate instructional modeling.

3. Methodology

Responding to calls from Barry (2012) to "examine teacher perceptions of the impact of instructional coaching during implementation of new instructional strategies" (p. 89), Wilhelmus (2015) that further "research would be beneficial to track teacher's attitudes and perceptions on how the MICs support them" (p. 70), and Knight (2019) that "further study needs to be conducted on the impact instructional coaching can have on implementation" (p. 14), this study investigated the predictive ability of MIC roles on teachers' perceptions of their impact on instruction in K-12 public school mathematics classrooms. Emanating from the literature, one research question and one null hypothesis catapulted this study:

RQ: Can relationship, curriculum, and pedagogy predict a teacher's perception of the impact of the MIC?

H_0: Relationship, curriculum, and pedagogy cannot statistically significantly predict a teacher's perception of the impact of the MIC.

3.1 Population and Sample

The sampling frame of this study included 200 K-12 mathematics teachers from Lake County Public Schools (LCPS; pseudonym), a rural school division in southwestern Virginia that mirrored the commonwealth's decline in the mathematics pass rates dropping from 84% to 66% (VDOE, 2019), but whoemployed 10 MICs. Five supported 140 teachers in 11 elementary schools, and an additional five supported the 60 teachers at the four middle schools, four high schools, and one alternative education center. With the assistance of the MICs, LCPS performance on the Virginia Math SOL tests improved and has remained above an 80% pass rate since 2015 (VDOE, 2019).

3.2 Instrumentation

While Yopp et al.'s (2010)*Examining Mathematics Coaching* survey (*EMC*),a 34-item Likert-scale instrument with three sections that measure MICs--Relationship (Cronbach's α=.953), Topics Discussed (Cronbach's α=.973), and Teacher Impact (Cronbach's α=.967)--most closely aligned with the focus of this study, modifications in organization were needed. First, to expedite completion and increase response rates, the *EMC* was reorganized and distributed as a Google Form. Second, per the *EMC* authors' request, the modified instrument was renamed the *Teacher Perception and Impact Survey* (*TPIS*). Identical to the *EMC*, the *TPIS* consisted of the original 34 questions in its three sections. Employing a 5-point Likert scale ranging from *strongly disagrees* to *strongly agree*, the first 21 items addressed the three independent variables (IVs)--relationship, curriculum, and pedagogy--while the remaining 13 items utilized a 6-point Likert scale ranging from *did not discuss* to *very large impact* to assess the dependent variable (DV): teacher perception of impact on instruction. One additional question was added for teachers to delineate the grade band taught--elementary (K-5) or secondary (6-12)--to ensure respondents from both were included.

3.3 Data Collection

Once appropriate permissions were obtained, to comply with the county procedures, the invitation with the survey link was emailed to the LCPS Supervisor of Grants and Innovations (SGI) for distribution to the 20 building principals through their weekly bulletin. Upon receipt, the principals distributed the invitation to the mathematics teachers through their school emails. Two weeks later, the SGI posted a reminder to the principals requesting redistribution of the invitation to afford all teachers the opportunity to complete the survey.

4. Results

After a 3-week data collection period, the survey had a response rate of 15.5%. Of the 31 participants, 71% (*n* = 22) were secondary teachers (Grades 6-12) and 29% (*n* = 9) were elementary (Grades K-5). Per the Google Forms settings, participation in this study was voluntary and confidential, and all responses were deemed valid.

4.1 Teacher Perception of the MIC Relationship

The teacher's perception of the relationship with the MIC was assessed with the first four statements of Section 1: *MIC: Relationship.* The statements *I felt comfortable communicating with my coach* and *I valued my coach's input* had the highest overall mean scaled score at 4.71 (*SD* = .53), while *I felt comfortable with my coach reflecting on my teaching practices* was the lowest (*M* = 4.55, *SD* = .57; see Table 1).

Table 1
MIC: Relationship

Statement	*M*	*SD*
a) I felt comfortable communicating with my coach.	4.71	.53
b) I felt my coach respects my opinions and understands my situation and the challenges I face.	4.61	.62
c) I felt comfortable with my coach reflecting on my teaching practices.	4.55	.57
d) I valued my coach's input.	4.71	.53

4.2 Teacher Perception of the MIC's Knowledge of Curriculum and Pedagogy

Section 2 of the *TPIS* labeled *MIC: Topics Discussed* assessed curriculum with the first nine statements. The statement *My coach and I discussed mathematical content that I teach* (*M* = 4.58, *SD* = .56) had the highest mean scaled score, while *My coach and I discussed ways of incorporating investigative, inquiry-based or discovery-based mathematics learning into my lessons* and *My coach and I discussed ways to infuse more mathematical concept development into my lessons* (*M* = 3.90, *SD* = .87) had the lowest (see Table 2).

Table 2
MIC: Topics Discussed Curriculum

Statement	*M*	*SD*
a) My coach and I discussed significant and worthwhile mathematical content.	4.35	.61
b) My coach and I discussed mathematical content that I teach.	4.58	.56
c) My coach and I discussed ways to increase the level of cognitive demand of the mathematical content.	4.10	.83
d) My coach and I discussed mathematics content beyond the grade(s) I teach.	3.97	.98
e) My coach and I discussed ways of incorporating investigative, inquiry-based or discovery-based mathematics learning into my lessons.	3.90	.87
f) My coach and I discussed ways to infuse more mathematical concept development into my lessons.	3.90	.87
g) My coach and I discussed ways to infuse more mathematical problem-solving into my lessons.	3.97	.91
h) My coach and I discussed ways to engage students in thought-provoking activities centered on important mathematical ideas.	4.26	.82
i) My coach and I discussed ways to emphasize elements of mathematical abstraction of sense-making into my lessons.	3.97	.98

Pedagogy was assessed with the remaining eight statements in the *MIC: Topics Discussed* section. As shown in Table 3, the pedagogy statement *My coach and I discussed ways to increase student participation in mathematics lessons* (*M* = 4.32, *SD* = .83) was the highest overall mean scaled score, while *My coach and I discussed ways to encourage students to pursue intellectual rigor, constructive criticism and/or challenging of ideas* (*M* = 3.84, *SD* = .97) was the lowest.

Table 3 *MIC: Topics Discussed Pedagogy*

Statement	*M*	*SD*
j) My coach and I discussed ways to encourage students to pursue intellectual rigor, constructive criticism and/or challenging of ideas.	3.84	.97
k) My coach and I discussed ways to increase student participation in mathematics lessons.	4.32	.83
l) My coach and I discussed ways to create an environment where students listen to one another's mathematical ideas.	3.97	.88
m) My coach and I discussed ways to read or detect students' levels of understanding of the mathematics being taught.	4.06	.85
n) My coach and I discussed ways to improve the use of questioning strategies in the context of mathematics instruction (such as, but not limited to, higher-order questions, open questions or wait time).	4.00	.86
o) My coach and I set goals and objectives aimed at implementing ideas and addressing issues we discussed.	4.13	.81
p) My coach and I are reflective about my students' learning.	4.29	.74
q) My coach and I are reflective about my teaching practice.	4.19	.75

4.3 Teacher Perception of the MIC's Impact on Instruction

In the final section, the teacher's perception of MIC impact on instruction was assessed. The statement *Discussions with my coach about mathematical content* (*M* = 3.90, *SD* = 1.22) was found to have the highest mean scaled score and *Discussions with my coach about ways to improve the use of questioning strategies in the content of mathematics instruction (such as, but not limited to, higher-order questions, open questions or wait time)* was the lowest (*M* = 2.87, *SD* = 1.67; see Table 4).

Table 4 *MIC: Impact on Instruction*

Statement	*M*	*SD*
a) Discussion with my coach about mathematical content.	3.90	1.22
b) Discussions with my coach about ways of incorporating investigative, inquiry-based or discovery-based mathematics learning into my lessons.	3.19	1.33
c) Discussions with my coach about ways to infuse more conceptual understanding into my lessons.	3.45	1.31
d) Discussions with my coach about ways to infuse more problem-solving into my lessons.	3.13	1.50
e) Discussions with my coach about ways to "read" or detect students' levels of understanding.	3.42	1.39
f) Discussions with my coach about ways to improve the use of questioning strategies in the context of mathematics instruction (such as, but not limited to, higher-order questions, open questions or wait time).	2.87	1.67
g) Discussions with my coach about ways to engage students in thought-provoking activities centered on important mathematical ideas.	3.23	1.67

h) Discussions with my coach about ways to emphasize elements of mathematical abstraction or sense-making in lessons.	2.90	1.68
i) Discussions with my coach about ways to encourage student participation.	3.81	1.54
j) Discussions with my coach about ways to encourage students to pursue intellectual rigor, constructive criticism and/or challenging of ideas.	3.06	1.46
k) Discussions with my coach about goals and objectives aimed at implementing ideas and addressing issues we discussed.	3.35	1.43
l) Discussion with my coach about my students' learning.	3.87	1.09
m) Discussions with my coach about my teaching practice.	3.61	1.36

4.4Correlational Findings

The Pearson product-moment correlation coefficient (Pearson *r*) was calculated to determine the linear relationship between the variables. While the three IVs were statistically significant at the $p< .01$ level, upon further examination, curriculum ($r = .78$) and pedagogy ($r = .73$) were both in the high relationship category and relationship ($r = .50$) was in the low category (see Table 5).

Table 5 *Correlations* ($N = 31$)

		Teacher perception of impact	Relationship	Curriculum	Pedagogy
Pearson correlation	Teacher perception of impact	1.00	.50	.78	.73
	Relationship	.50	1.00	.51	.50
	Curriculum	.78*	.51	1.00	.71
	Pedagogy	.73**	.48	.71	1.00
Sig.(one-tailed)	Teacher perception of impact	.	< .01	< .01	< .01
	Relationship	< .01	.	< .01	< .01
	Curriculum	< .01	< .01	.	< .01
	Pedagogy	< .01	< .01	< .01	.

*Correlation is statistically significant at the 0.01 level (one-tailed).

**Correlation is statistically significant at the 0.05 level (one-tailed).

4.5 Standard Multiple Regression (SMR) Findings

Prior to the SMR analysis, six assumptions were tested to ensure validity. Casewise diagnostics confirmed the absence of extreme outliers greater than ± 3 standard deviations, while a regression residuals histogram and a normal probability plot confirmed normally distributed residual errors. A scatter plot of the studentized residuals against the standardized residuals demonstrated no gross violations of homoscedasticity, while the Durbin-Watson value of 2.342 confirmed the independence of observations. Bivariate regression plots of each IV confirmed linearity and the absence of multicollinearity was confirmed with acceptable tolerance levels (i.e., above .20) and the variance inflation factor did not exceed 4. Consequently, no violations were found, so it was deemed suitable to proceed with the SMR.

The null hypothesis stating that relationship, curriculum, and pedagogy cannot statistically significantly predict a teacher's perception of the impact of the MIC, was tested using the SMR model. The linear combination of these three role categories accounted for 64% of the variation (adjusted $R^2 = .64$) in teacher perception of impact. This model was statistically significant, $F(3, 27) = 18.64$, $p< .01$ (see Table 6); therefore, the null hypothesis was rejected.

Table 6 *Multiple Regression*

	SS	*df*	*MS*	*F*	Sig.
Regression	4909.80	3	1636.60	18.64	< .01
Residual	2371.04	27	87.82		
Total	7280.84	30			

Curriculum (*B*= .49, $p < .01$) and pedagogy (*B* = .35, $p = .04$) made statistically significant contributions to the model, while relationship was not statistically significant (*B* = .09, $p = .52$). The resultant unstandardized regression equation for predicting teacher perception of MIC impact on instruction, including all three unstandardized coefficients was $Y' = 1.26x_1 + 1.01x_2 + .65x_3 - 48.26$, where *Y*' = predicted teacher perception of MIC impact on instruction, x_1 = knowledge of curriculum resources, x_2 = facilitator of pedagogy, and x_3 = professional relationships with teachers (see Table 7).

Table 7 *Coefficients* (*N* = 31)

	B	*SE*	*B*	*t*	Sig.
(Constant)	-48.26	16.15		-2.99	< .01
Relationship	.65	1.00	.09	.66	.52
Curriculum	1.26	.42	.49	3.01	< .01
Pedagogy	1.01	.46	.35	2.22	.04

5. Discussion

Supporting previous studies that teachers perceived one-to-one collaboration and in-class PD as impactful on instruction (Catapano, 2020; Desimone, 2013; Knight, 2019; 2021; Will, 2020), results from the *TPIS* data revealed that respondents had a generally positive perspective of MICs and their impact on instruction (AISR, 2004; Deussen et al., 2007; DeWitt, 2015; Knight, 2004a), particularly in the MIC role categories of knowledge of curriculum resources--what is being taught--and facilitation of pedagogy--how students learn (Hull et al., 2009; Killion, 2009; Killion et al., 2012; Knight, 2019; Kretlow et al., 2009; Wilhelmus, 2015). Even though this study did not reaffirm the existing literature's correlation on the MIC category of professional relationships as the basis of all positive MIC-teacher interactions (Hanover Research Report, 2014; Hull et al., 2009; Knight, 2004b, 2009; Steiner & Kowal, 2007), it did provide a gateway for future research on how to perform MIC relationship roles that are more impactful on instruction. Additionally, improved understanding of MIC roles improves teachers' perceptions of both the MIC and the effectiveness of the overall coaching program (Knight, 2009; Wilkins, 2014). This study also raised awareness by suggesting implications for three constituents of the schools: administrators, MICs, and classroom teachers.

5.1 Implications for Administrators

One implication derived from this study is for division administrators to ensure that MICs have adequate training in their content area, both through academic rigor and professional experience. Second, administrators may need to balance the amount of collegiate coursework preparation with knowledge of resources gained by experience using "adopted curriculum . . . pacing guide[s], and scope of concepts" (Killion, 2009, p. 11) for the development of instruction.

5.2 Implications for MICs

One implication for MICs is to prioritize PD opportunities focusing on those that will extend knowledge of curriculum resources and facilitation of pedagogy roles to most impact the instruction of teachers with whom they work. Second, MICs need to have training sessions within their district to ensure full understanding and application of the district and state resources provided for the teachers, such as pacing guides, curriculum frameworks, test blueprints, crosswalks for standards changes, just-in-time quick checks, mathematics vertical articulation tools, rich mathematical tasks, and mathematics instructional plans. A third implication is that MICs need to be cognizant of how to fulfill the impactful categories of knowledge of curriculum and facilitation of pedagogy in a virtual environment. The COVID-19 pandemic temporarily altered some educational environments, but some divisions have recognized the positive results of remote learning and have begun organizing virtual education centers and opportunities. MICs will need to determine how best to support teachers and instruction in these new settings.

5.3 Implication for Classroom Teachers

A final implication of this study is that teachers need opportunities to collaborate with their MICs. Classroom teachers are currently pulled in many different directions, especially with the alternative instructional methods required from COVID-19, and they have numerous requirements on their time within the school day.

Allocating a designated time to work with a MIC would encourage the sharing of ideas, resources, and expertise to improve instruction and time efficiency. This would also work to resolve any reluctance teachers have about inviting MICs into their classrooms or attending collaboration sessions with them (Mason, 2007).

5.4 Limitation

The limitation of this study was the low response rate (15.5%) on the *TPIS*, especially by the elementary teachers. Only 29% (n = 9) of them responded. Perhaps one reason for this was that the survey distribution and communication was conducted solely by the LCPS SGI due to the LCPS survey research protocols. A second explanation pertaining to the overall response rate was the overwhelming plethora of obligations mathematics teachers were experiencing due to COVID-19 that may have caused them to be incapable of having the time to participate. Finally, the elementary mathematics teachers may have had little or no contact with their MIC due to the LCPS elementary school MICs serving a dual purpose, coaching both mathematics and reading, causing those teachers to be reluctant to respond to the survey. In contrast, secondary MICs focus solely on mathematics thus potentially increasing teacher interactions and response rates to the survey.

5.5 Recommendations for Future Research

Two recommendations emerged from this study. The first is for future research to use the preferred method of random rather than that of convenience sampling (Creswell, 2015). Random sampling would provide more generalizable results rather than results specific to one school division. A different sampling method would also employ an alternate distribution method that could increase the response rates and make results more universal. Using a random sample from a population employing MICs for less than 5 years might also explain the anomaly with the *relationships with teachers* IV found in LCPS who have employed MICs for over 10 years.

A second recommendation involves utilizing the categories of each MIC role in an assessment tool for MIC professional growth. Currently, there are no nationally recognized evaluation tools to assist MICs with improving their work with students, teachers, and/or administrators. A self-, teacher-, or peer-evaluation tool would be the first step in feedback for MICs to set standards and develop areas of focus for PD. Focus on the roles performed defined with each MIC category would also be the groundwork for an administrative evaluation tool.

6. Conclusion

While this study added to the research on MICs, it also echoed the need for additional studies on the MIC roles, specifically as they apply to teacher perception of impact on instruction, particularly within grade bands. Furthermore, the data emphasized continued research on the MIC roles to provide an assessment tool that would assist with professional growth.

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